Thermally Robust IBS Coatings for Deep Concave Surfaces

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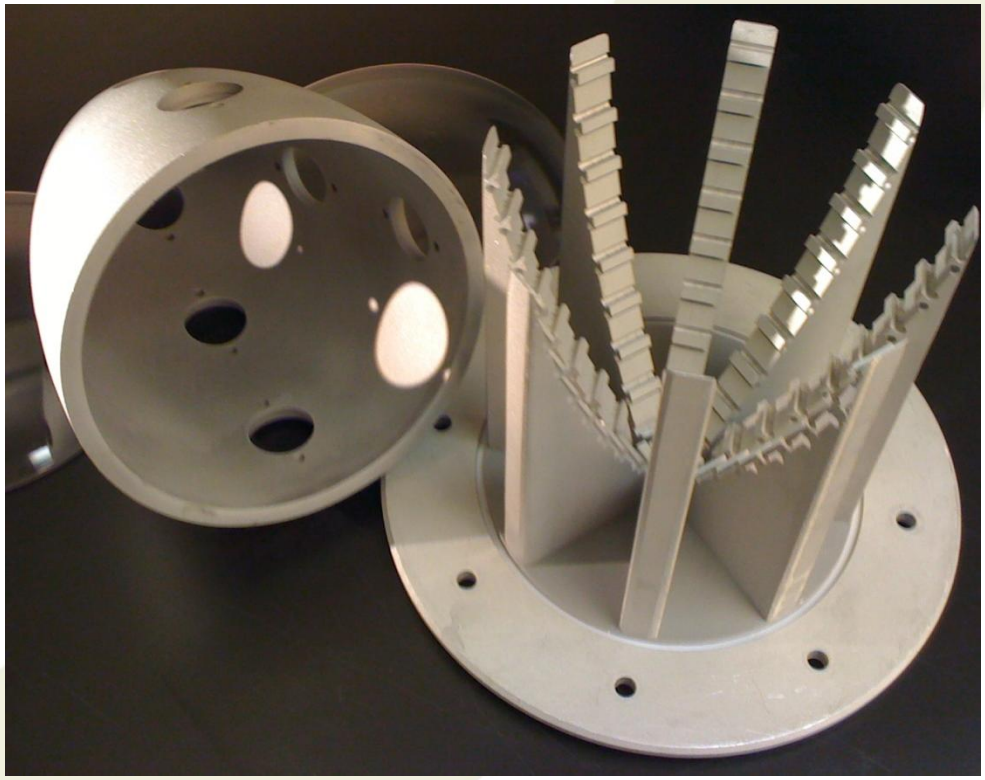

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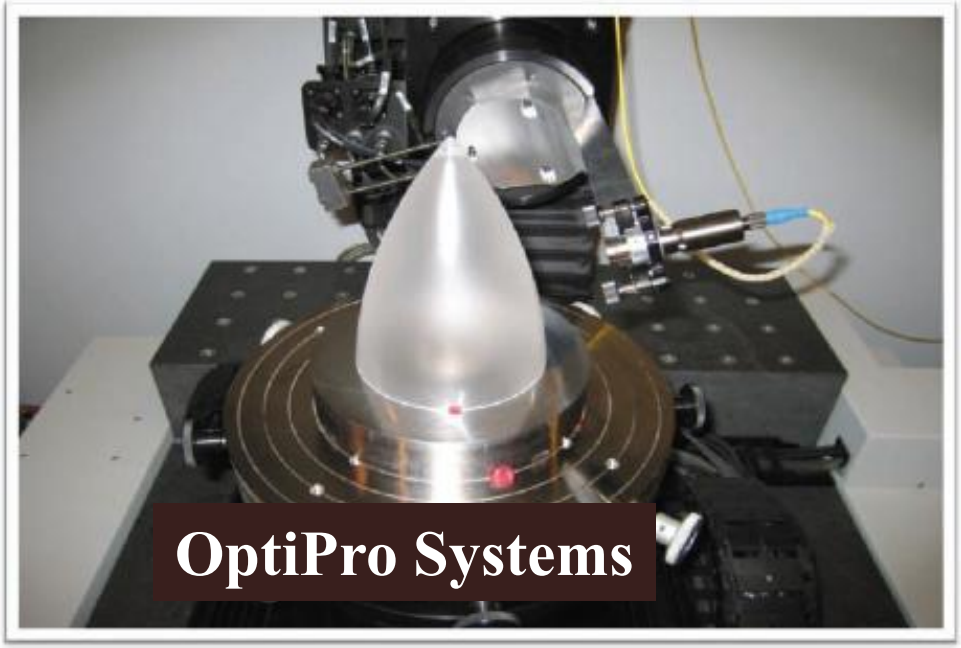
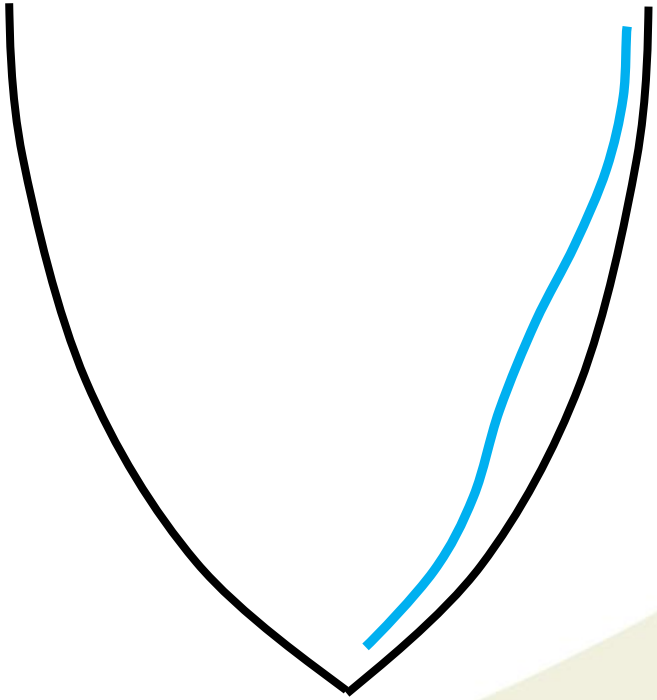
The Challenge

- Dome shape trend: Hemispherical dome → tangent ogive
- Improved aerodynamics:
  - decrease drag, temp., increase range, speed
- Increased durability against rain, etc.
- Increased optical field of regard
- Issues:
  - High temperature operation (~1000ºC) required
  - more complex optic, more complex coatings necessary
  - Spatially-varying coating profile required in order to optimize AR coating for a wide range of look angles within the dome

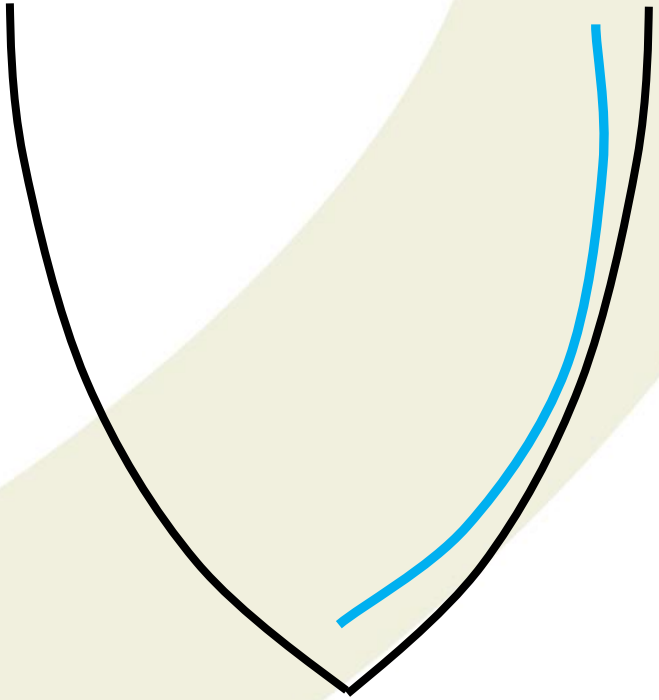


If you just put the dome in a coating chamber…

What you get:

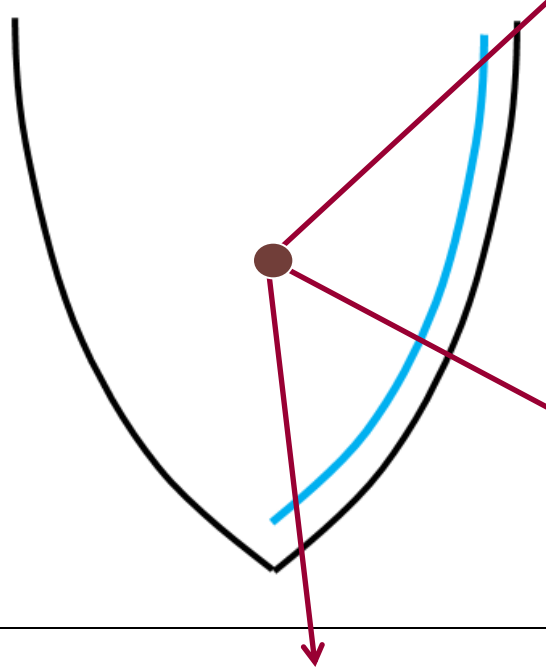


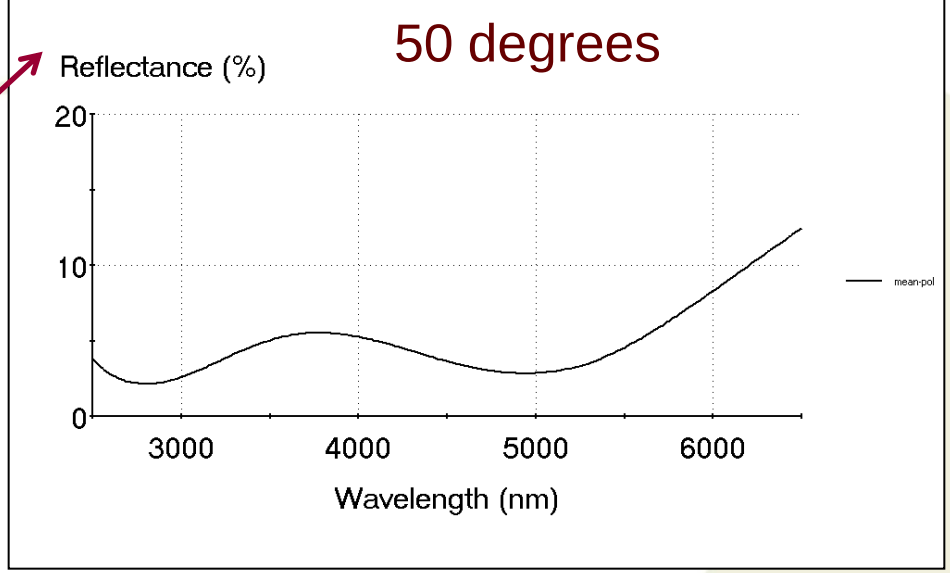
What you want:

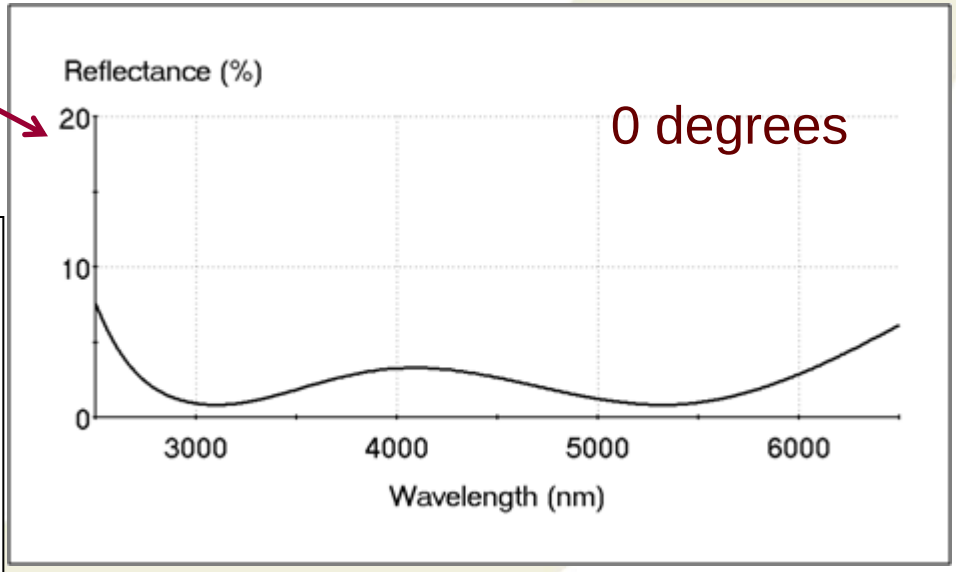


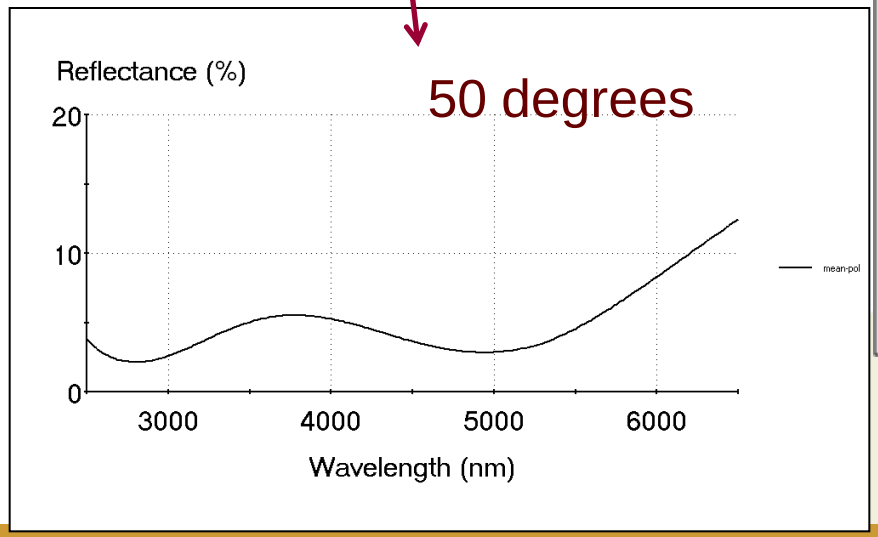
Uniform thickness profile

incorrect







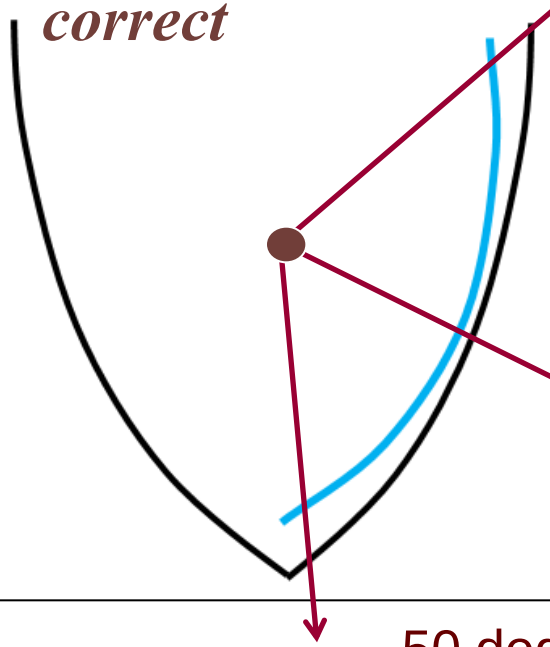


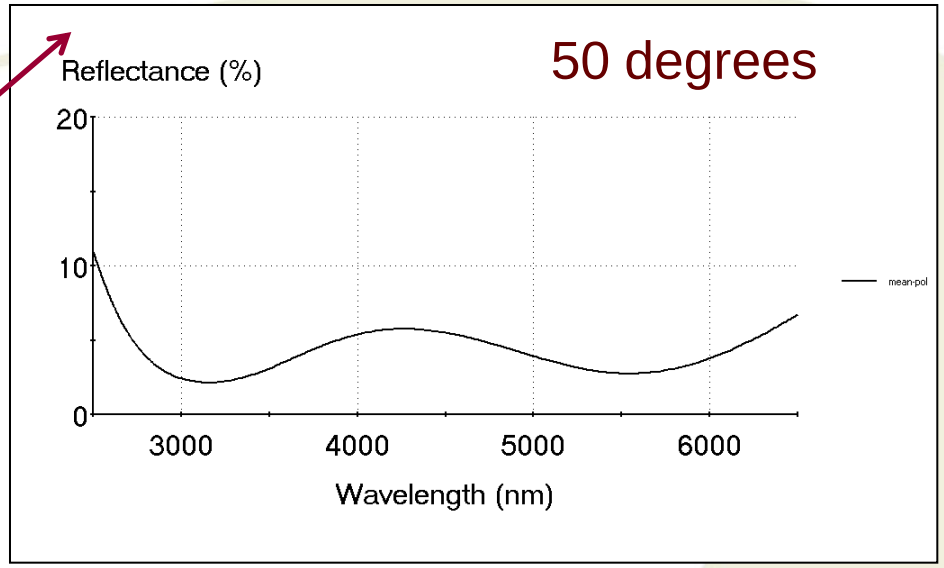
The coating thickness challenge

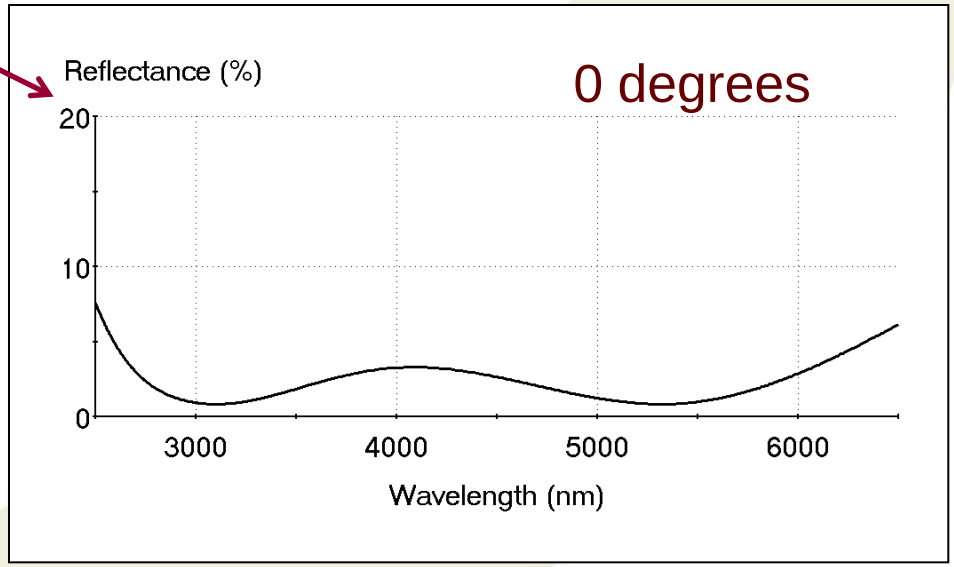
(Mean polarization shown)

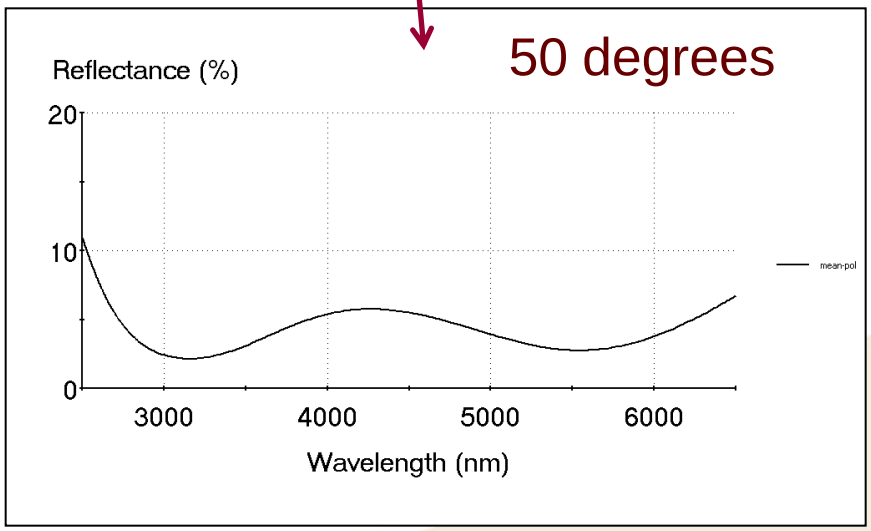
Spatially-varying thickness profile

correct





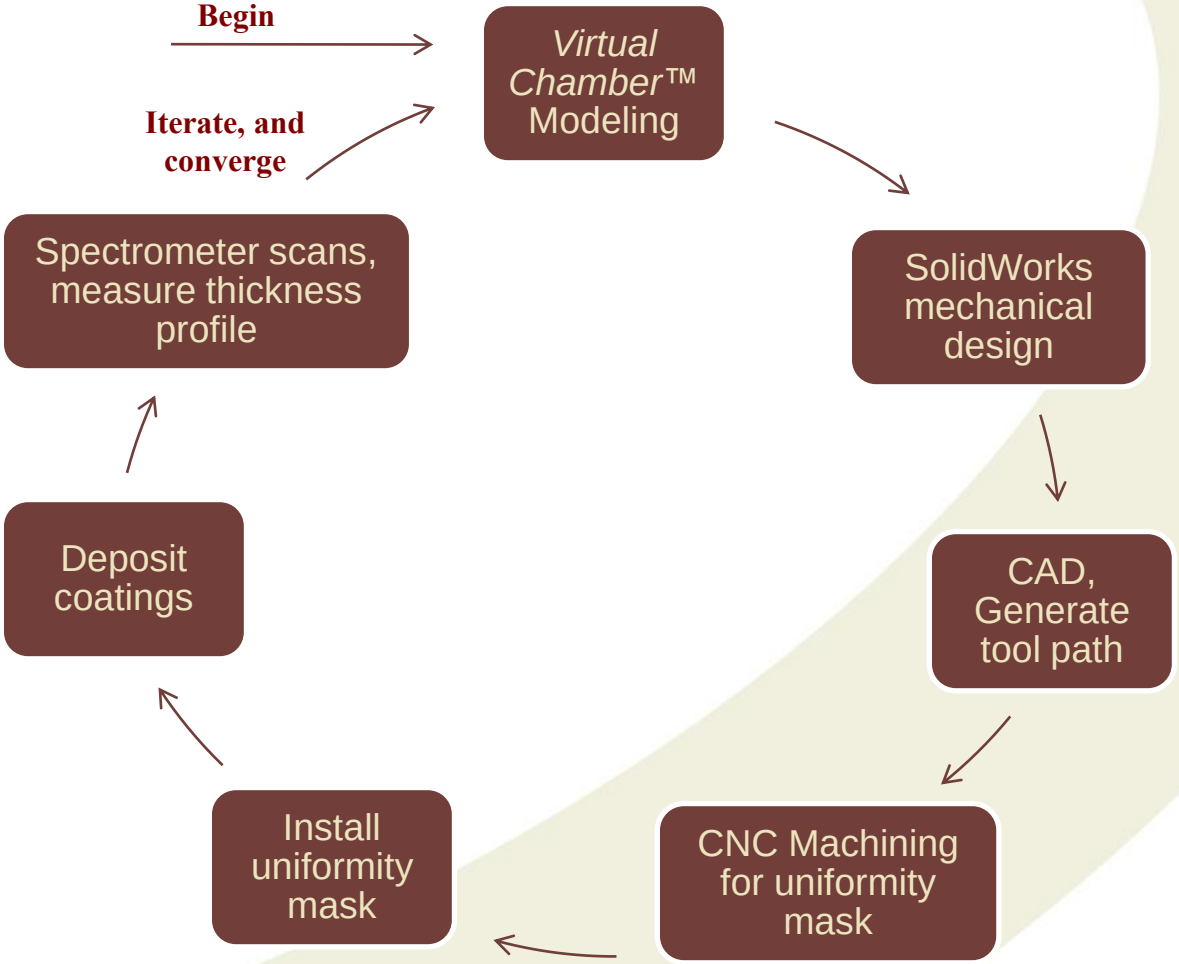




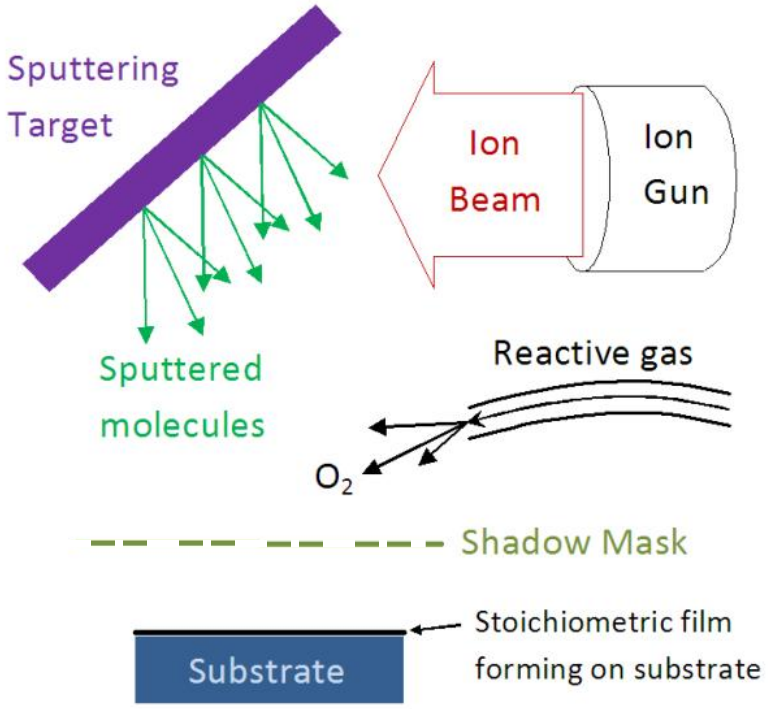
The coating thickness challenge

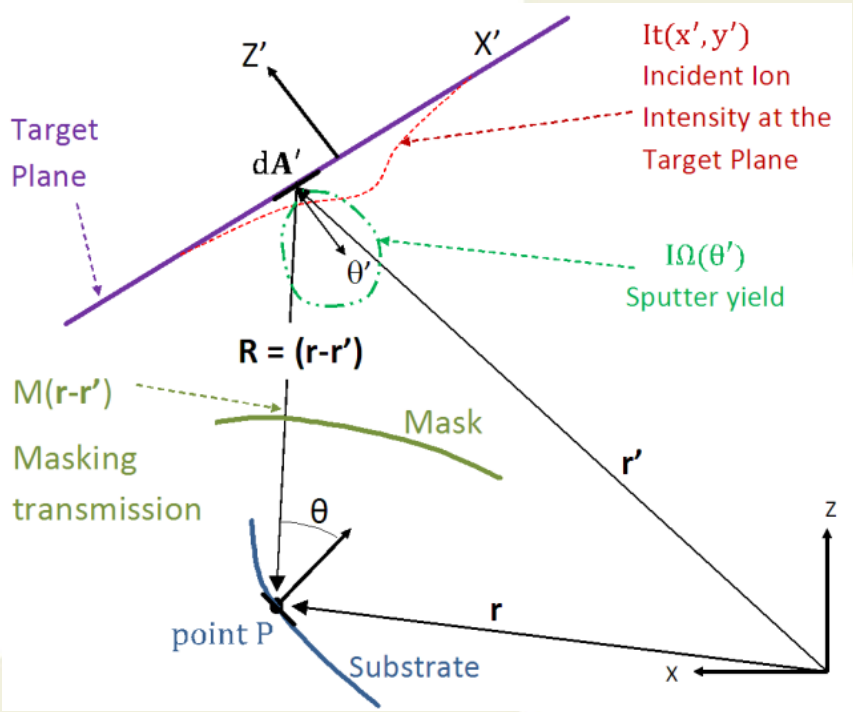
(Mean polarization shown)

PPC's Solution

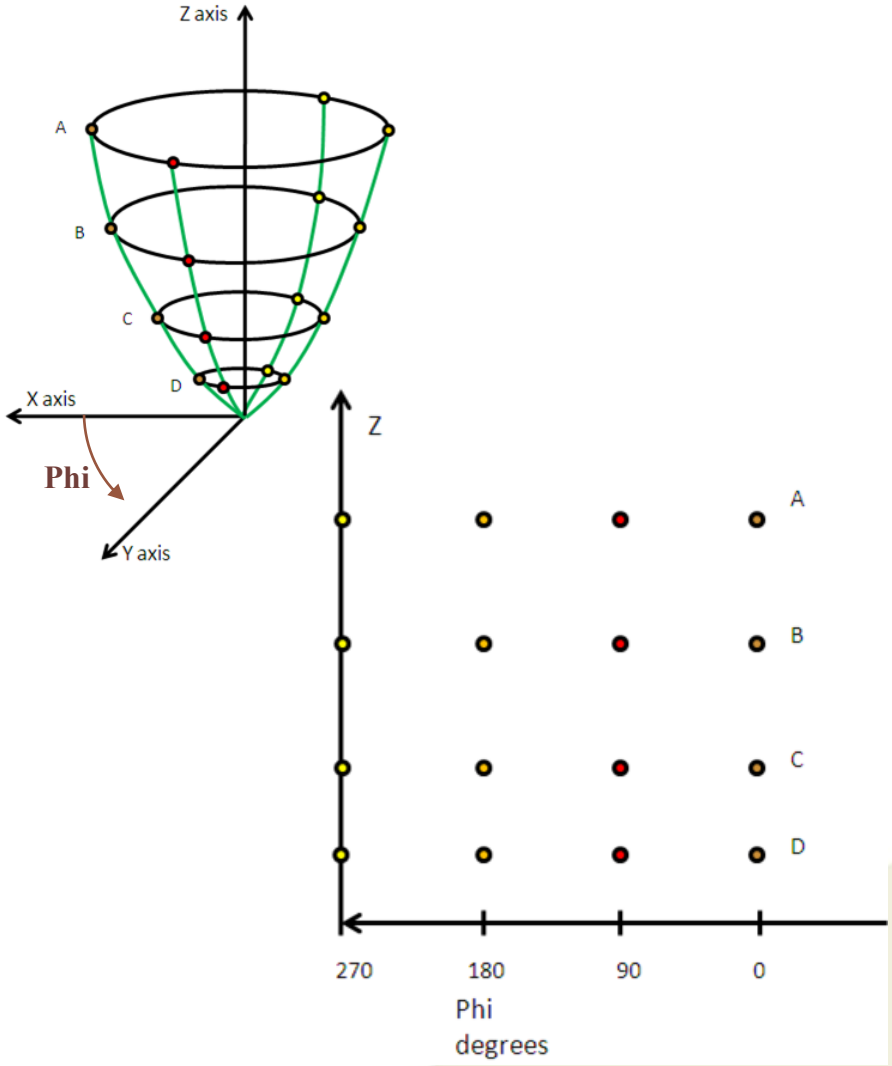


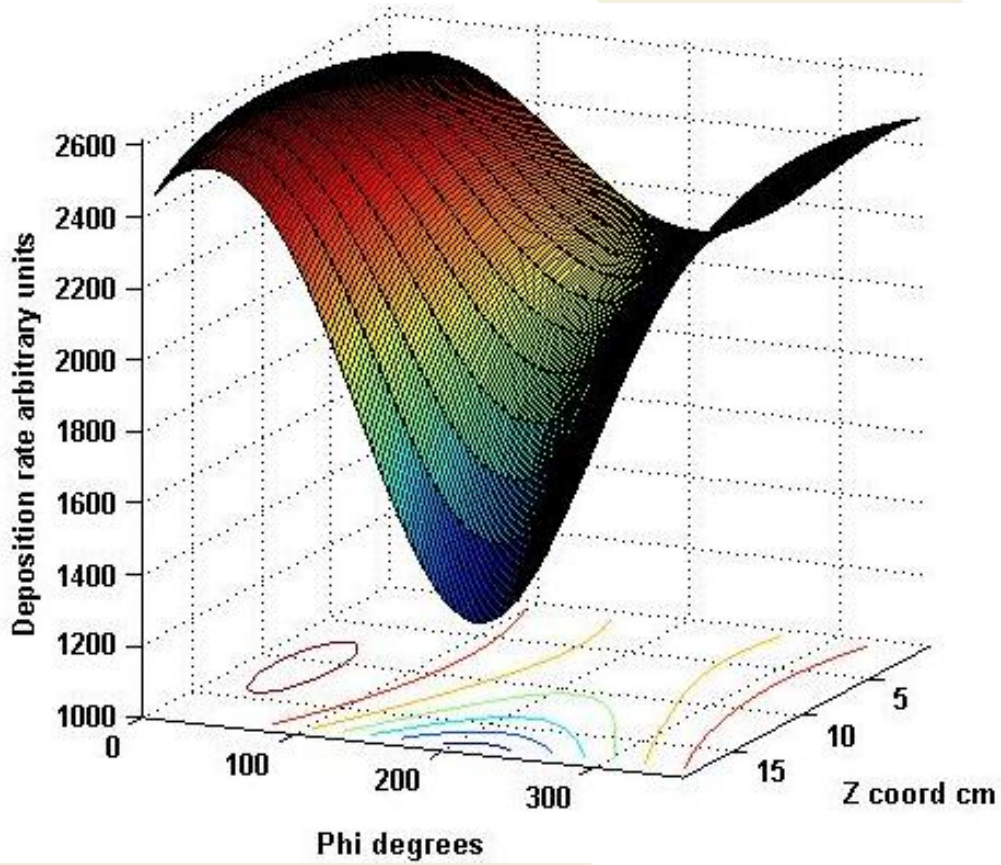
IBS Model: *Virtual Chamber™*



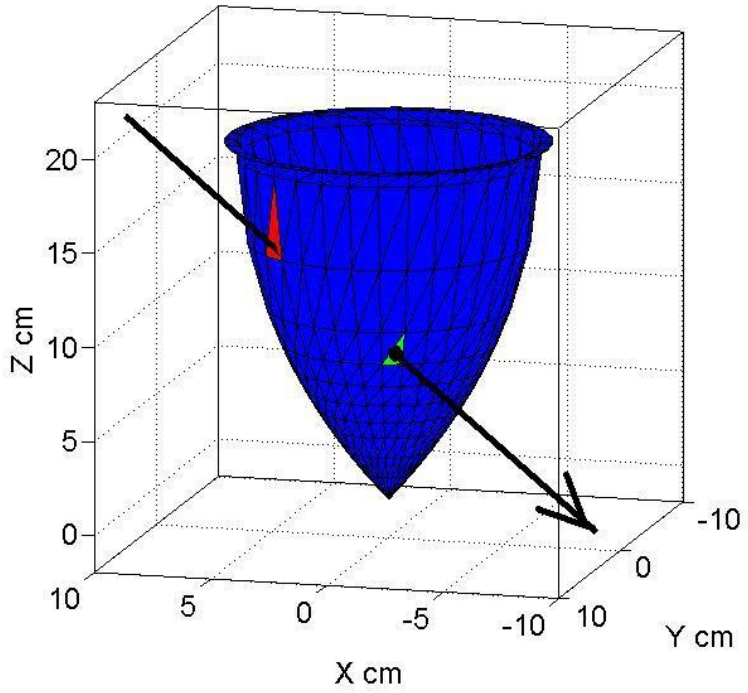


Virtual Chamber™ → Dome Rate Field

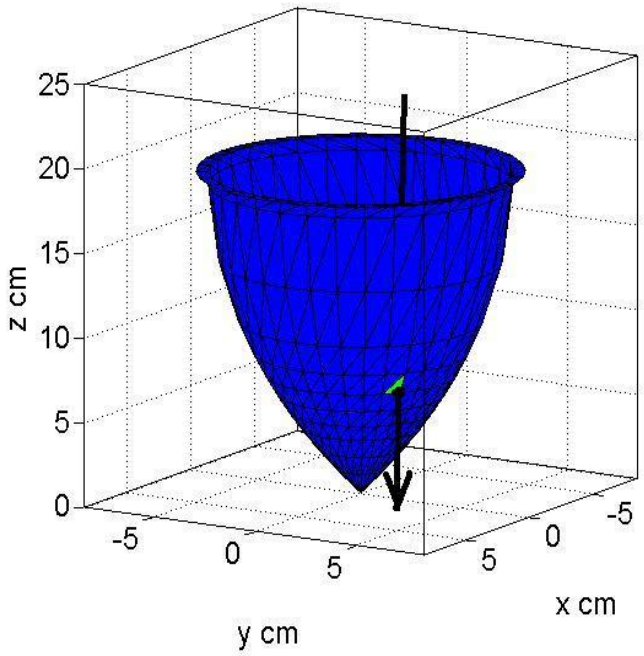




Virtual Chamber™ →Uniformity Masking



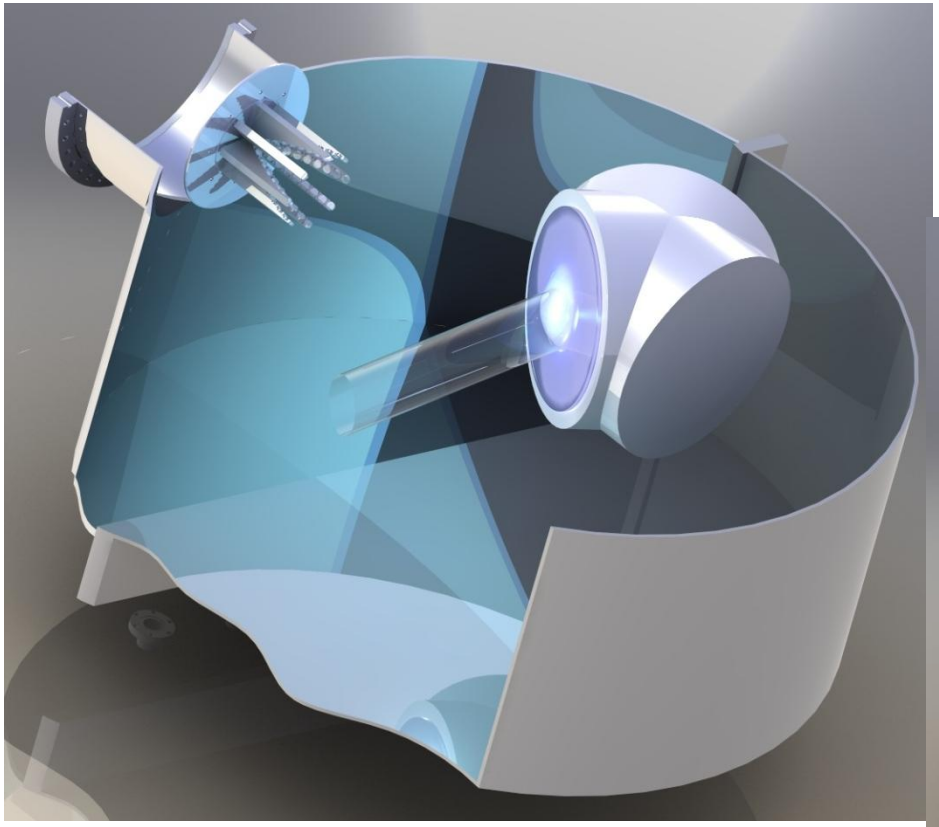
Rays indicate material path from sputtering target to dome surfaces

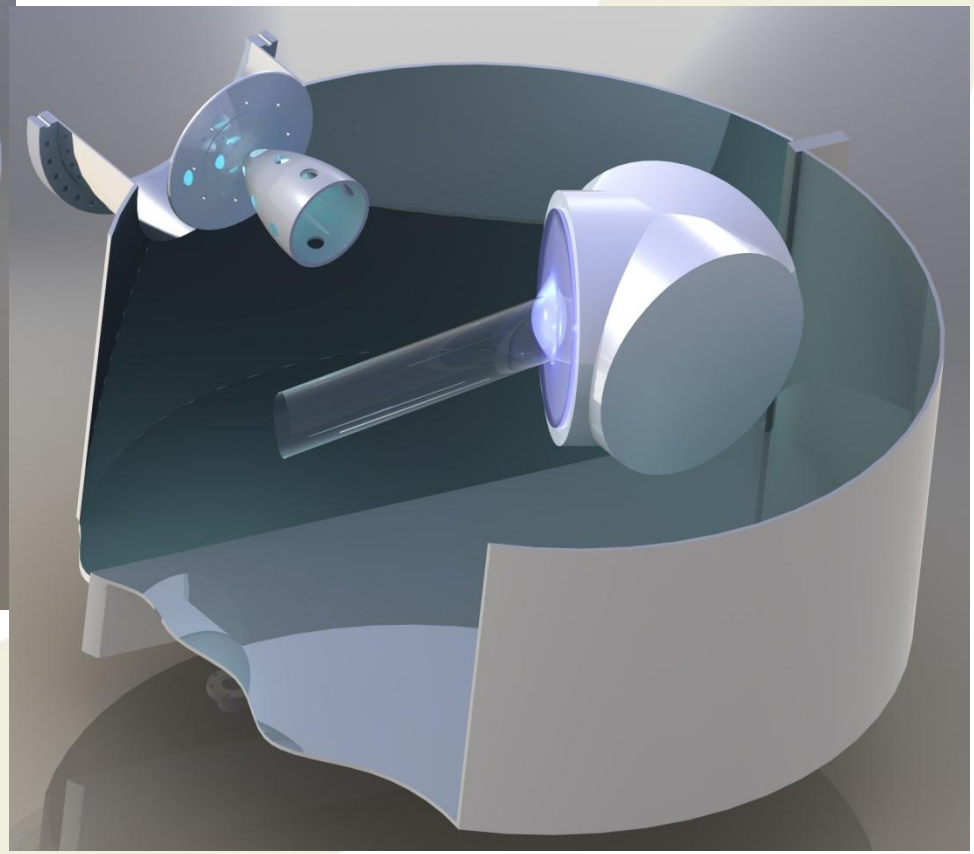


Goal:

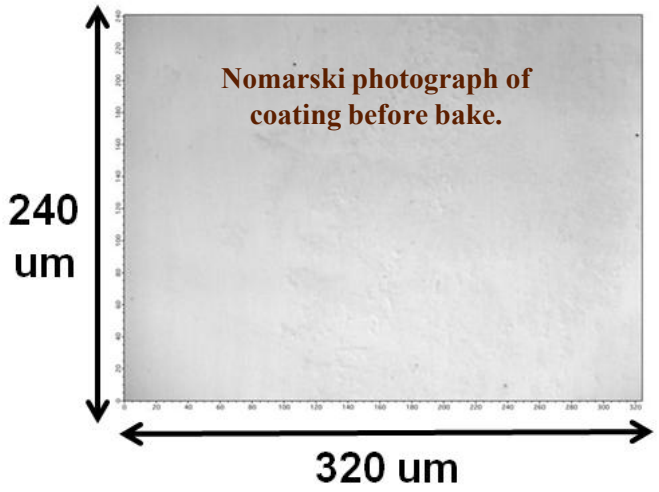
Tailor which 'paths' are allowed to reach the dome surface, as a function of position along the dome interior. Use mechanical masking of sputter distribution to accomplish this

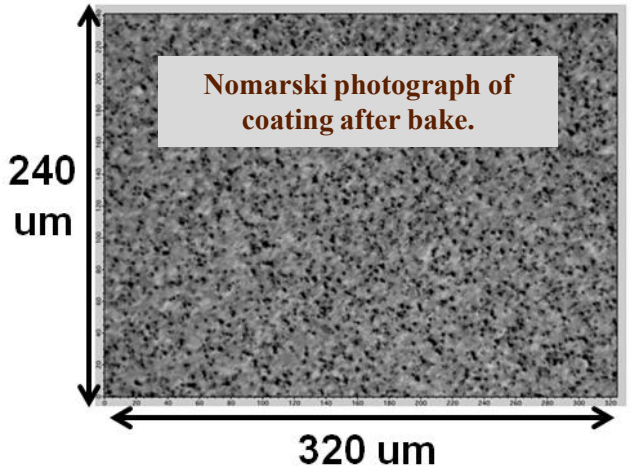
Virtual Chamber™ → SolidWorks

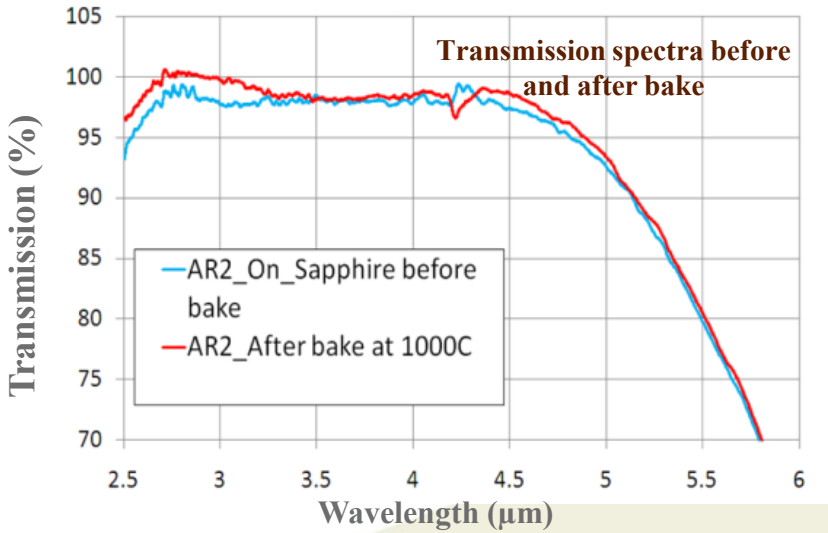


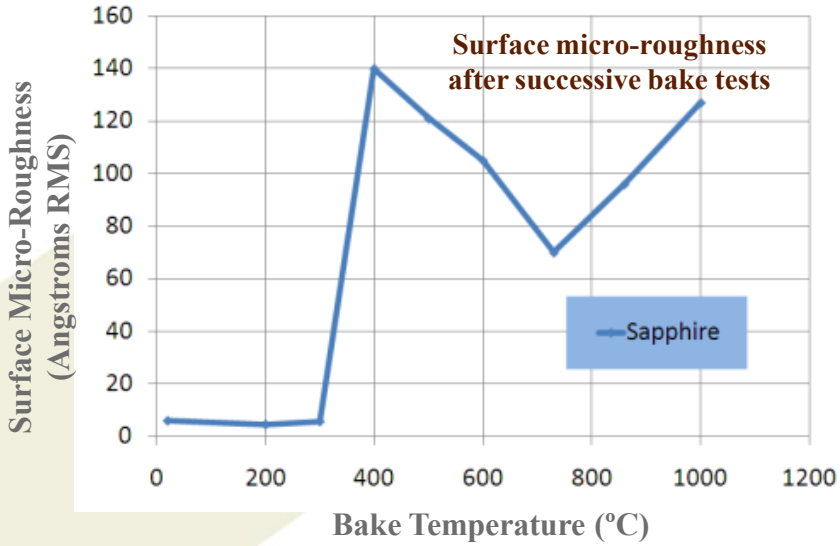


1000ºC Operation

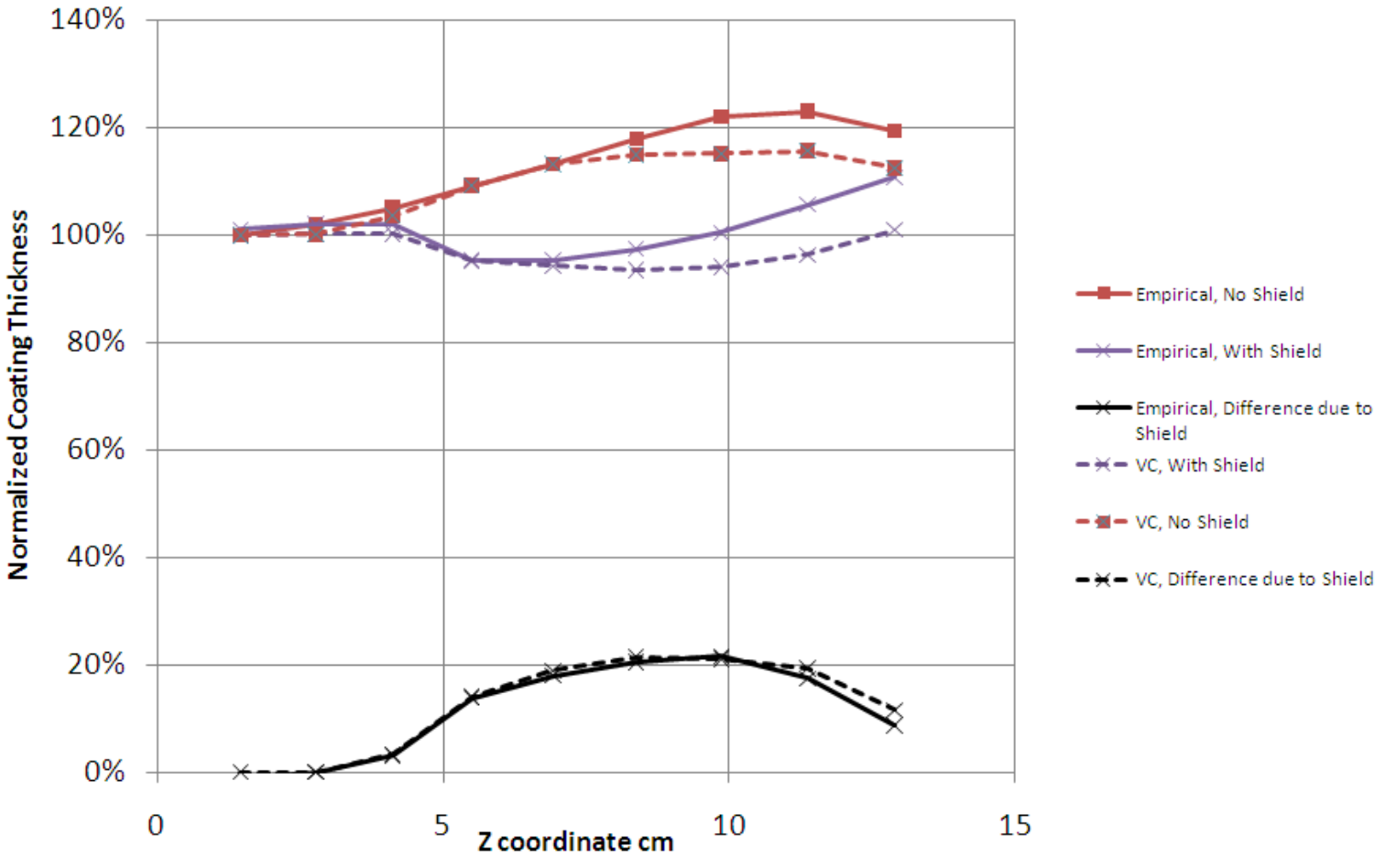




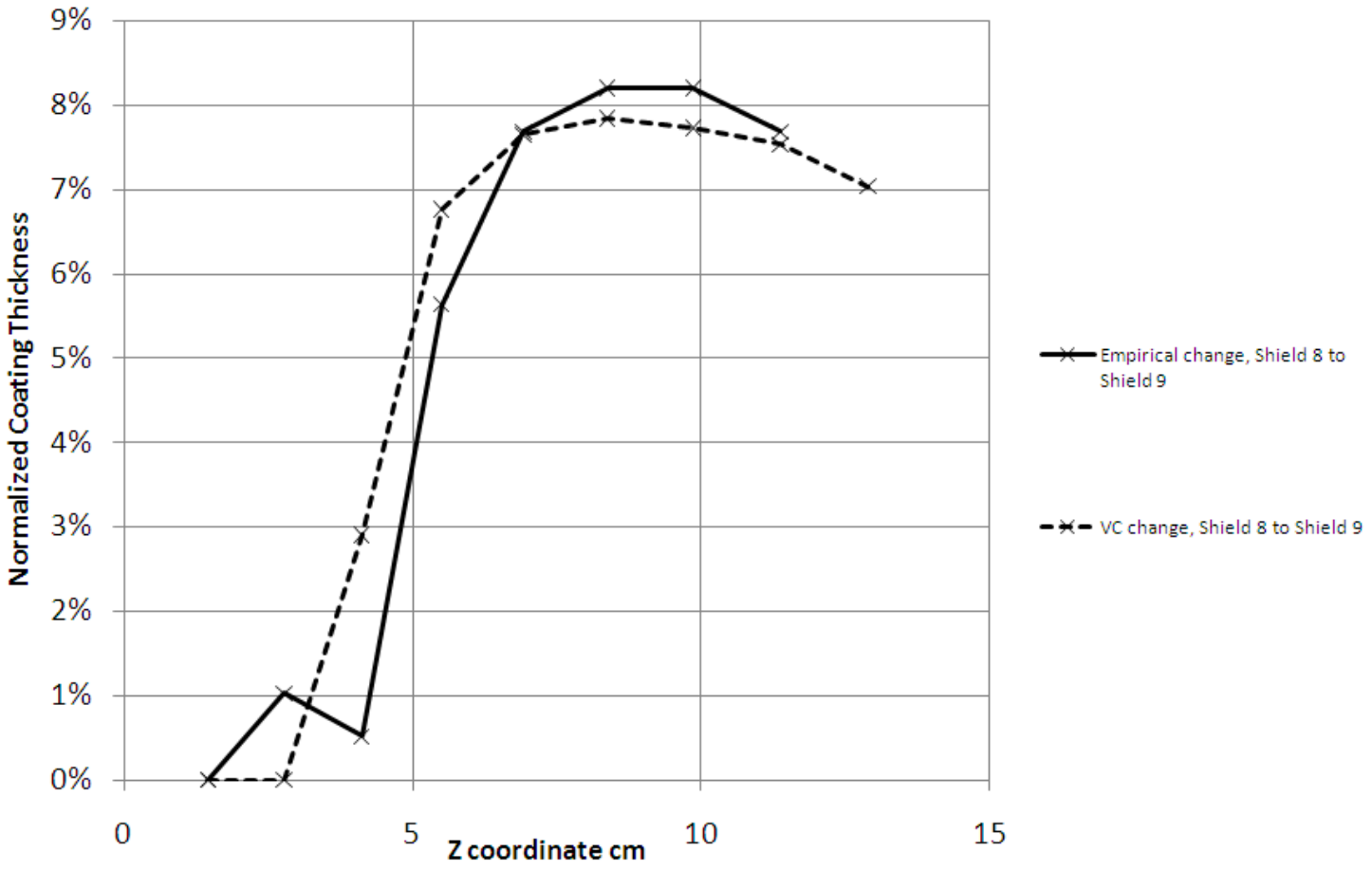




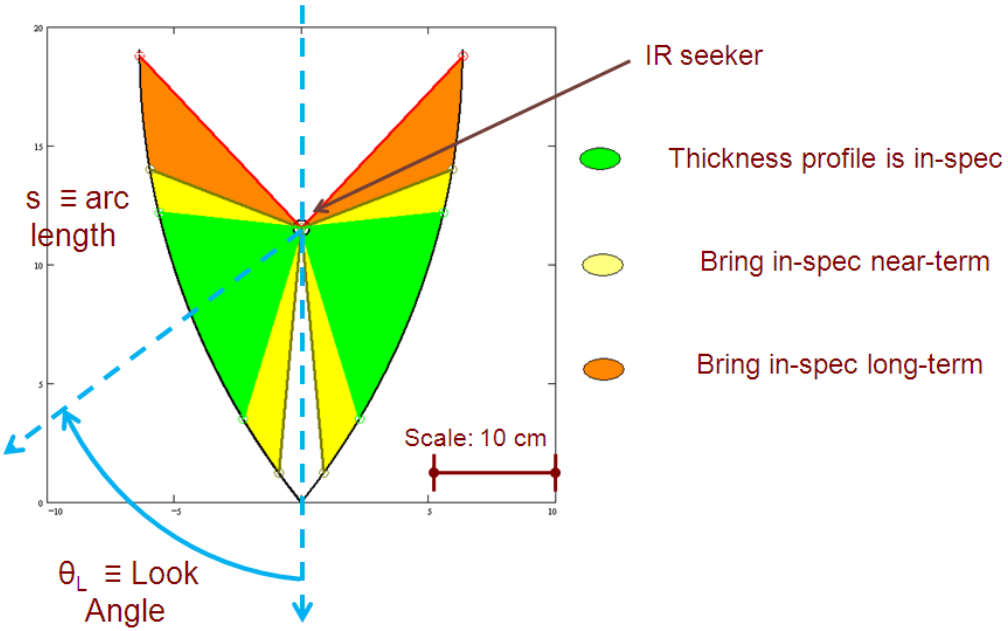
Modeling vs Experiment

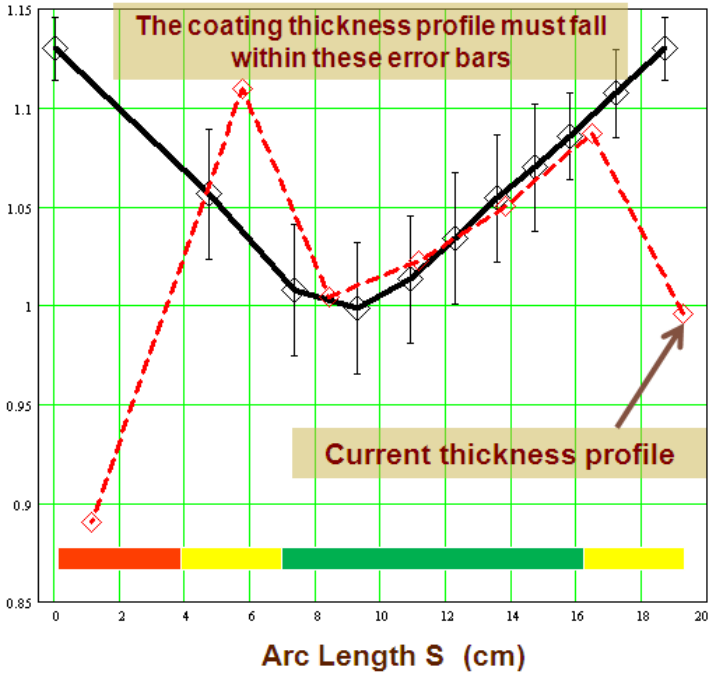


Iteration: Old Mask → New Mask



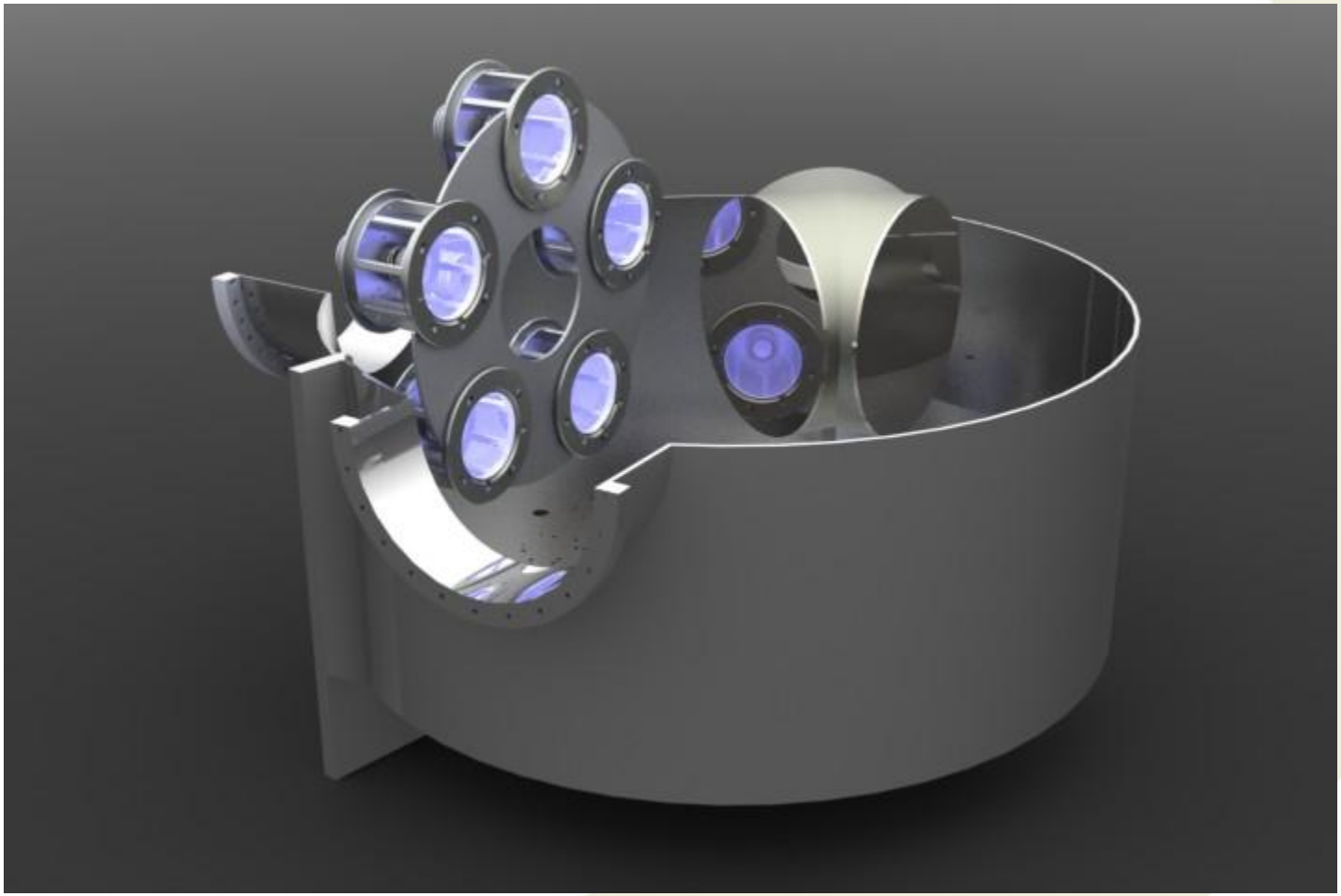
Conclusion and Summary





- **Demonstrated a robust AR coating on sapphire that survives exposure to 1000ºC**
- **PPC's *Virtual Chamber*™ model is operational and reliable**
- **Tooling concept for coating dome interiors works reliably, will be modified for dome exteriors**
- **Achieved specified coating thickness uniformity over a look angle range of 16º to 96º**

Coating Multiple Domes



……Questions?

Small
Business
Innovation
Research

Title of Success Story Product/Service

SBIR Company Name
City, State

INNOVATION

Brief description of the new technology/application. (Please try to state what the technology does in a clear, plain-spoken manner.)

Hollow Cathode Plasma Electron Emitters

ACCOMPLISHMENTS

- Development stage (e.g., prototype, small production runs, etc.).
- Significant technical achievements and noteworthy business developments to date.
- Cumulative private capital investment by firm to date (*if not commercially sensitive*).
- Other evidence of private-sector commitment.

COMMERCIALIZATION

- Identify product/service name; trademark name.
- Indicate number of associated patents, patent applications to date.
- Brief description of primary target market sectors; distinguish actual from potential market sectors.
- State if product/service currently being sold or available for sale, by market sector; if not, provide expected entry date into market, by market sector.
- Cumulative sales revenues to date by market sector (*if not commercially sensitive*).
- Statement regarding other demonstrated customer interest to date.
- Other associated cumulative revenues generated to date (e.g., from licensing fees, royalties, sell-off of the technology) (*if not commercially sensitive*)
- Identify venture structure (e.g., new profit center/business segment within existing firm, spinoff entity, joint venture partnership, other strategic alliance).
- Identify names of joint venture/strategic alliance partner firms (*if not sensitive*)
- Describe unique competitive advantage of the new technology, with respect to specific, existing customer needs in each target market sector.

GOVERNMENT/SCIENCE APPLICATIONS

- Brief description of the product service for NASA and other USG applications; distinguish between actual and potential applications.
- Remaining technological or business development necessary for NASA/USG application.
- Identify NASA and other USG missions utilizing the product/service; distinguish between actual and potential applications.
- Statement regarding other demonstrated NASA/USG customer interest to date.
- NASA and/or other USG Phase III contracts (w/$ amounts).
- Estimate of NASA mission/project cost savings due to SBIR innovation/product developed.

Contacts: MSFC, Tom Knight: 256-544-5353
Company, PO: phone
19__ Phase _: NAS8-39358